Enrollment No: _____ Exam Seat No: _____

C. U. SHAH UNIVERSITY
Winter Examination-2022

Subject Name: Operations Research

Subject Code: 4SC06OPR1 **Branch: B.Sc. (Mathematics)**

Semester: 6 **Date: 26/09/2022** **Time: 11:00 To 02:00** **Marks: 70**

Instructions:
(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1 **Attempt the following questions.** **(14)**

a) Define: Basic solution 01

b) Define: Surplus variable 01

c) True/False: Every Linear programming problem can be solve graphically. 01

d) Define: Saddle point 01

e) PERT stands for____. 01

f) MODI stands for_____. 01

g) True/False: Every Transportation problem is Linear programming problem. 01

h) Define: Pure Strategy 01

i) When total supply is not equal total demand in a transportation problem then it is called_____ transportation problem. 01
(a) Balance (b) Unbalance (c) Degenerate (d) None

j) For maximization problem in Big-M method, objective function coefficient for an artificial variable is_____. 01
(a) +M (b) – M (c) 0 (d) None

k) Which of the following method is used to find initial solution to the transportation problem. 01
(a) NWCR (b) LCM (c)Vogel's Approximation (d) All of these

l) Games which involves more than two player are called_____. 01
(a) Conflicting games (b) Negotiable games
(c) N-person games (d) All of these

m) When all the elements of replacement ratio column are equal, this situation is known as_____. 01
(a) Tie (b) Degeneracy (c) Break (d) None of these

n) In LPP, degeneracy occurs in _____stages. 01

(a) one (b) Two (c) Three (d) Four

Attempt any four questions from Q-2 to Q-8

Q-2 **Attempt all questions** **(14)**

(a) A farmer has a 100 acre farm. He can sell all tomatoes, lettuce or radishes and can get a price of Rs.1.00 per kg for tomatoes, Rs. 0.75 a heap for lettuce and Rs.2.00 per kg for radishes. The average yield per acre is 2,000 kg of tomatoes, 3,000 heaps of lettuce and 1,000 kg of radishes. Fertilizers are available at 0.50 per kg and the amount required per acre is 100 kg each for tomatoes and lettuce and 50 kg for radishes. Labour required for sowing, cultivating and harvesting per acre is 5 man - days for tomatoes and radishes and 6 man - days for lettuce. A total of 400 man - days of labour are available at Rs. 20 per man - day. Formulate this problem as a linear programming model to maximize the farmer's total profit. Formulate this problem as an LP model. 07

(b) Solve by using graphical method: 05

$$Max\ Z = 5x + 8y$$
$$Subject\ to,$$
$$3x + 2y \leq 36$$
$$x + 2y \leq 20$$
$$3x + 4y \leq 42$$
$$and\ x, y \geq 0$$

(c) Write General Mathematical model of Linear programming problem. 02

Q-3 **Attempt all questions** **(14)**

(a) Company produces 2 types of hats A and B. Every hat A requires twice as much labour time as the second hat B. If the company produces only hat B then it can produce a total of 500 hats per day. The market limits daily sales of hat A and B to 150 and 250 respectively. The profits on hat A and B are Rs. 8 and Rs. 5 respectively. Formulate this problem as LPP model and then solve graphically. 07

(b) Solve by using Simplex method. 07

$$Maxximize\ Z = 3x_1 + 2x_2 + 5x_3$$
$$Subject\ to,$$
$$x_1 + 2x_2 + x_3 \leq 430$$
$$3x_1 + 2x_3 \leq 260$$
$$x_1 + 4x_2 \leq 420$$
$$and\ x_1, x_2, x_3 \geq 0$$

Q-4 **Attempt all questions** **(14)**

(a) Write down limitation of linear programming problem. 05

(b) Find the value of game for the pay-off matrix given below. 04

		Player B		
		B_1	B_2	B_3
Player A	A_1	1	3	1
	A_2	0	-4	-3
	A_3	1	5	-1

(c) Write Short note on Degeneracy in Simplex algorithm. 03

(d) Write general mathematical form of Transportation problem. 02

Q-5 **Attempt all questions** **(14)**

(a) Solve given Linear programming problem. 07

$$Maximize\ Z = 5x_1 - 4x_2 + 3x_3$$
$$Subject\ to,$$
$$2x_1 + x_2 - 6x_3 = 20$$
$$6x_1 + 5x_2 + 10x_3 \leq 76$$
$$8x_1 - 3x_2 + 6x_3 \leq 50$$
$$and\ x_1, x_2, x_3 \geq 0$$

(b) Find initial basic solution to the given transportation problem by using VAM. 07

		Destination				
		D_1	D_2	D_3	D_4	$Supply$
Origins	O_1	11	13	17	14	250
	O_2	16	18	14	10	300
	O_3	21	24	13	10	400
	$Demand$	200	225	275	250	

Q-6 **Attempt all questions** **(14)**

(a) Write steps of simplex method. 07

(b) Find optimal solution to the given Transportation problem. 07

	Destination				
		D_1	D_2	D_3	D_4	Supply
Origins	O_1	6	1	9	3	70
	O_2	11	5	2	8	55
	O_3	10	12	4	7	70
	Demand	85	35	50	45	

Q-7 **Attempt all questions** **(14)**

(a) Solve given LPP by using Big-M method 07

$$Maximize\ Z = 2x_1 + 3x_2$$
$$Subject\ to,$$
$$x_1 + x_2 \geq 2$$
$$x_1 + 2x_2 \leq 8$$
$$and\ x_1, x_2 \geq 0$$

(b) Write steps of MODI method. 07

Q-8 **Attempt all questions** **(14)**

(a) Write basic Difference between CPM and PERT. 05

(b) For what value of λ, is the game with the following matrix strictly determinable? 05

		Player B		
		B_1	B_2	B_3
Player A	A_1	λ	6	2
	A_2	-1	λ	-7
	A_3	-2	4	λ

(c) Construct a network for each of the projects whose activities and their precedence relationships are given below. 04

Activity	A	B	C	D	E	F	G	H	I
Predecessor	-	A	A	-	D	B,C,E	F	D	G,H